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Note on the + and — signs before $\surd$, by Prof. Johnson.—The question raised by Prof. Judson is one of conventional notation, viz.—shall we regard $\surd a$ as indicating sometimes the positive and sometimes the negative square root of a, or definitely the positive root. The advantage of making a distinction is unquestionable, and naturally the arithmetical root is written without sign thus $\surd 2 = 1.41+$. So also there are n nth roots of a, but there is an advantage in restricting the symbol $\sqrt[n]{a}$ to the arithmetical nth root, to the exclusion of the imaginary roots which have their own appropriate symbols. In like manner $\sin^{-1}x$ is by a useful convention restricted to that arc whose sine is x which is between $-\frac{1}{2}\pi$ and $+\frac{1}{2}\pi$; since the expressions $\pi - \sin^{-1}x$, $2\pi - \sin^{-1}x$ &c., will then express without ambiguity the other arcs of which x is the sine.

If this convention is adopted we cannot of course say that a radical equation necessarily has a root. Thus the two equations $x + \surd(ax+b) = c$ and $x - \surd(ax+b) = c$ give rise to the same quadratic, which quadratic will have two roots real or imaginary, and it may be shown of either of these roots that it must satisfy one or other of the radical equations, but in some cases both roots belong to one of the equations and no root at all to the other.

Prof. Johnson adds—"As no one has answered my paradox published in the March No., I will mention the solution of the falacy. It consists in the tacit assumption, that under the definitions, every conic has a pole. For a conic which *has* a pole, the construction in (2) is correct. Moreover every straight line has four poles, the intersections of the system of conics whose poles lie on the line. But if we pass two conics through two *given* points, it will not generally happen that these conics admit of poles, hence the line mentioned in (5) does not generally exist, and the general conclusion in (6) is founded on a non-entity."

PROBLEMS.

75. **By D. Brown, Grafton, Ill.**—A stick of timber of uniform density and size from end to end, has a weight of 600 pounds suspended at one end by which it is balanced horizontally on a fulcrum 6 feet from the end where the weight is suspended. If the fulcrum be 5 feet from the same end the stick will be balanced with a weight of 800 pounds. Required the weight and length of the stick.

76. **By Isaac H. Turrell, Cumminsville, Ohio.**—Within a given circle to draw three others tangent to it and touching each other externally, the sum of whose diameters shall be equal to that of the given circle.

77. By O. H. Merrill, Watertown, N. Y.—Within the circumference of a given circle, radius r, describe two equal circles, radii $\frac{2}{3}r$, which shall touch the first circle internally at opposite extremities of a diameter. Describe a fourth circle D, touching the first circle internally and each of the two equal circles externally. Describe a fifth circle E, a sixth circle F, &c., touching the first internally and one of the two equal circles and the circle D, E, F, &c., respectively, externally. Find an expression for the radii of the circles E, F, G, &c.

78. By Prof. J. Scheffer, Gambier, Ohio.—From a given point without a triangle to draw a line which bisects the area of the triangle.

79. By Henry Gunder, Greenville, Ohio.—Prove that the formula $2^{n-1}(2^n - 1)$ represents a perfect number when $2^n - 1$ is prime.

80. By Prof. A. B. Evans, Lockport, N. Y.—The relation

$$\underline{|n} = 1 + A_1\frac{n}{\underline{|1}} + A_2\frac{n(n-1)}{\underline{|2}} + A_3\frac{n(n-1)(n-2)}{\underline{|3}} + \dots + A_n\frac{\underline{|n}}{\underline{|n}}$$

is true for all positive integral values of n; show that

$$\frac{Ar}{\underline{|r}} = 1 - \frac{1}{\underline{|1}} + \frac{1}{\underline{|2}} - \frac{1}{\underline{|3}} \dots + \frac{(-1)^r}{\underline{|r}},$$

where r is an integer less than n.

81. By G. W. Hill, Nyack Turnpike, N. Y.–"Prove that, *identically*,

$$\frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \dots + \frac{1}{2n} = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots - \frac{1}{2n}."$$

82. By Prof. A. Hall, Naval Obs., Washington, D. C.—If the parabolic orbits of two comets intersect the circular orbit of the earth in the same two points, then if t_1 and t_2 be the times in which the comets move from one point to the other, $(t_1 + t_2)^{\frac{2}{3}} + (t_1 - t_2)^{\frac{2}{3}} = \left(\frac{4}{3\pi}\right)^{\frac{2}{3}}$: a year being the unit of time.

ERRATA.

On page 88, 1st line, the exponent of the factor $(1 - f')$ should be $\frac{3}{2}$.
" 91, line 13, for 396 read $396x$.
" 95, " 6 from bottom, for "$nn.$" read nn'.
" 99, " 15 from bottom, for make read mark.
" 100, " 18, for f, g, read f', g',.
" 103, " 22, for number read numerator.
" 107, " 18, for ρ_2^2 read ρ_3^2.
" 109, " 14, after first parenthesis insert ρ_1^2.
" 118, Fig. 5, for "A" within the figure read H.